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SOME ECO-FRIENDLY BIOPESTICIDES FROM NAGPUR DISTRICT

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ABSTACT

Our country is endowed with rich diversity of species of Asteraceae family; a number of species are known to have pesticide properties, which can be proved to be pest specific. The present paper is the survey of such plants having pesticide properties and can be used for further studies.

KEYWORDS: Biopesticide, Asteraceae Family & Nagpur

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INTRODUCTION

Nagpur district is endowed with a variety of flora, which can be considered as the store house of plant protection chemicals like flavonoids, alkaloids, essential oil etc. Nowadays, there is a renewed interest in botanicals because of the adverse effects of chemical pesticides. Still, recently only the plants with toxic chemicals were considered as suitable for plant protection. The discovery of antifeedant, insect growth regulators and other behavior modifying chemicals in plants against insect pest, fit into the concept of insect pest management assume importance (F. Brisca, 2009).

However, synthetic insecticides have serious drawbacks such as pest resurgence and resistance, lethal effects on non-target organisms, the risk of users, contamination, food residues and environmental pollution (Tapondjou *et al*., 2002). Biological control is the use of one or more types of beneficial organisms, usually called natural enemies, to reduce the numbers of another type of organism, the pest (Susan E. Rice Mahr *et al*., 2001). In addition, the precautions necessary to work with traditional chemical insecticides (Fields *et al*., 2001) and the poor storage facilities of a traditional farmers in developing countries, which are unsuitable for effective conventional chemical control (Tapondjou *et al*., 2002) emphasize the necessity of new effective methods for insect pest control of crops.

As Asteraceae family is nested high in the angiosperm phylogeny Asterideae/Asterales. The family contains the largest number of described, accepted species, of any plant family, CA. 24,000, with estimates of the total number reaching 30,000. There are 1600-1700 genera distributed around the globe except for Antarctica. Assuming that there are 250,000-350,000 species of flowering plants, then out of every eight to twelve species is in Compositae (about 10%) (Vicki A. Funk *et al*. 2002). Asteraceae family having compounds like flavonoids, saponins, tannins, phenols, steroids, terpenoids, etc. In the present paper some common plants of Asteraceae family having biopesticide potential are discussed.

Ageratum conizoides L. (Sahadevi, Goat weed).

Habit: Herb.

Original Article

Plant Distribution: Common throughout along roadsides, waste places and forest edges.

It is an annual, branching herb which grows up to 1m in height. The stem and leaves are covered with fine white hairs, the leaves are ovate and up to 7.5cm long. The flowers are purple to white, less than 6mm across and arranged in a terminal inflorescence. The fruits are achenes and easily dispersed. Because of its propagation, it becomes a weed and causes problems for farmers and ecologists. Seeds are positively photoblastic, and viability is often lost within 12 months (Tailor Chandra Shekhar and Goyal Anju, 2012).

Flowers and Fruits: July-February

Compounds and Biopesticide Properties:

Aerial parts of *Ageratum conizoides* contained 11 chromenes, nine methoxyflavones (like 5,6,8,3',4',5'-hexamethoyflavone and 8-hydroxy-5,6,7,3',4',5'-hexamethoyflavone), sitosterol, (+)-sesamin and caryophyllene oxide. Other components of this plant are alkaloids, flavonoids, benzofurans and terpenoids. The plant shows insecticidal properties.

Ageratum conizoides has bioactive activity that may have agricultural use as shown by several research investigations, in different countries. Pereira in 1929, cited by Jaccoud (1961), reported use of the leaves as an insect (moth) repellent (Tailor Chandra Shekhar, 2012). The insecticide activity may be the most important biological activity of this species (Harborne, 2010). Both the essential oil and as well as the major components of the oil, namely the precocenes, have been reported to have antijuvenile hormonal activity (Shirwaikar A *et al*, 2003).

A. Coincides possesses hormone antagonist precocene I and II and *Artemesia vulgaris* contain a substance sesquiterpenoid location named as 'Vaughan' (Sharada Singh and Rao P.J., 1999).

Hexane crude extract of *A. conizoides* (Coumarin) shows insecticide activity (toxicity) to *Sitophilous zeamais, Rhyzopertha dominica, Oryzaephilus surinamensis* of stored products (Marcio Dionizio Moreira *et al*., 2007).

The extracts of *A. conyzoides* shows the larvicidal and ovicidal activity of aqueous and ethanolic extracts of leaves on the eggs (unembryonated and embryonated), first and second larval stages of *Heligmosomoides baker*i (J. Wabo Pan *et al*., 2011).

Caesulia axillaris Roxb. (Bangra, Caesulia)

Habit: Herb

Plant Distribution: It is a common weed in rice fields (Marshy places) throughout India.

Herbs, prostrate or suberect, annual. Leaves sessile, oblong-lanceolate, acute at apex. Heads compound, 1cm across, globose, white or purplish. Pappus of 2 ovate scales. Achenes 0.3*0.2 cm, flat, obovate, slightly notched.

Flowers and Fruits: September-February

Biopesticide Properties

Its essential oil has been reported against some insect pests causing deterioration of food commodities (Verma and Dubey, 2001). It can be used as a fungicide, the efficacy of *C. Auxiliaries* essential oil against *A. Flavors* LHPtc and other molds causing deterioration of naturally stored herbal raw materials so that the oil may be recommended against the fungi associated with raw during their processing (Prashant Kumar Mishra *et al*., 2012).

The essential oil of *Caesulia auxiliaries* protected stored gram and wheat from *C. chinensis*, *S. oryzae* and *T. castaneum* for first 12 months of storage (Kumar R. *et al*., 2007), (Verma J.*et al*., 2001).

Bidens biternata (Lour.)

Habit: Herb.

Plant Distribution: throughout as a Common weed in gardens and in waste places.

Annuals herbs, up to 80cm high, erect; stem quadrangular, ribbed, hairy. Leaves alternate or imparipinnate to bipinnate, ultimate leaflets ovate, acute. Heads yellow c 1.3cm in diameter, in terminal or leaf opposed peduncles. Pappus setae 2-4retrorsely hispid, bristly. Achenes c 1.5 cm long, linear, black.

Flowers and Fruits: August-September

Compounds and Biopesticide Properties

Heads contain polyacetylenes, chalcone and aurone glycosides, volatile oil, sterols, acylated okanin glycoside, gallic acid and phenols. Seeds and the whole plant are insecticidal. They are used for aphids, cutworm and termites.

It is used to repel pests in stored grain as well as aphids, ants, beetle, cabbage root fly, caterpillars, crickets, mites and termites. *Bidens biternata* also have some active components like chalcones, aurone glycosides, volatile oils, acylated okanin glycoside, gallic and oxalic acid and phenolic astringents. Some of these, particularly the volatile oils, are considered responsible for the mosquito repellent (T. C. Kazembe and S. Nkomo, 2012).

Leaves of *Bidens pilosa* and soap powder were used as an insecticide for the control of leaf miners and other insects. Similarly, PAN (2008) indicated that *B. pilosa* was effective against aphid, cutworm and termites. Likely, in this study, *B. pilosa* was minimized the number of onion thrips population, but exhibited low mortality rate percentage (Tadele Shiberu and Amin Mahammed, 2014).

Blumea eriantha DC.

Habit: Herb

Plant Distribution: Common throughout in fields and in open forests.

Herbs, erect, perennial. Leaves 2.0-7.5*1-2cm, lower leaves obovate, upper leaves elliptic-oblong, margins serrate. Heads yellow. Pappus white, longer than achenes, scanty. Achenes minutely hairy.

Flowers and Fruits: December-May

Compounds and Biopesticide Properties

The leaves yield an essential oil rich in ketones such as carvotanacetone and l-tetrahydrocarvone. Seeds also yield a volatile oil with a camphor-like smell. The essential oil is found larvicidal against *Culex pipiens* and *Culex fatigans*. It is generally used as an insect repellent.

Blumea eriantha is used as a mosquito repellent.

Echinops echinatus Roxb.

Habit: Herb

Plant Distribution: Common throughout in dry places under open situations.

Herbs, 30-90 cm high, much branched, rigid, annual, 30-90cm high. Leaves sessile, 2-10cm long, oblong, deeply pinnatifid, glabrous or minutely pubescent. Heads c 1.5 cm across (excluding spines), white, surrounded by strong white bristles. Pappus short, yellow, forms a short cylindrical tuft above achenes. Achenes 0.5 cm long, obconic, densely villous.

Flowers and Fruits: **September-January**

Compounds and Biopesticide Properties

Plant leaf extract of *Echinops echinatus* on mycelial growth of *S. rolfsii* were significant (Muhammad Farooq *et al*., 2010). It has a potential of fungicide.

Eclipta prostrata (L.)

Habit: Herb.

Plant Distribution: Common throughout in wet situations.

Annual herbs, erect or prostrate. Leaves sessile, oblong-lanceolate or oblong-elliptic, sparsely strigose on both surfaces. Heads c 0.5 cm across, solitary or 2-together, on unequal, axillary peduncles, yellow. Achenes oblong-obovate, tubercles all over, trigonous, brown to black.

Flowers and Fruits: **July- February**

Compounds and Biopesticide Properties

The extract of roots, shoot and the whole plant showed nematicidal activity against nematode species like *Meloidogyne graminicola*, *Meloidogyne incognita* and *Rolylenchulus* species due to the presence of thiophenes and thienyls.

Field testing of *E. Alba* for seed treatment of sorghum. *E. Alba* extract and Calthio C caused significant inhibition of *Leptosphaeria saccharin* Breda de Haan (syn. *Phoma sorghina* Sacc.) *in vitro*. In field trials, a stimulatory effect on seedling emergence and yield increases of 7 to 38% were observed in *E. Alba* and the pesticide treatments, as compared to no treatment (Elisabeth P. Zida, 2012).

It shows mosquito larvicidal activity against *Culex sitiens* species (Latha C. *Et al*., 1999).

Leaf and root extract shows ovicidal to *S. cerealella* property against stored insects of rice (Prakash and Rao, 1997).

Tagetes erecta L.

Habit: Herb.

Plant Distribution: The '*African Marigold*', a native of Mexico is grown abundantly in gardens (Cooke, op. cit.; Naik, op. cit.).,

Herbs, 0.5-1.2 m high, stout, erect, annual. Leaves opposite or upper alternate, pinnately divided into lanceolate, serrate segments. Heads solitary, peduncled. Marginal florets with yellow, tubular corollas. Achenes linear-oblong, blackish. Pappus scales united.

Flowers and Fruits: September-October

Compounds and Biopesticide Properties

The flower heads of this plant, yield a volatile oil consisting of targeting, limonene, valeric acid, acumen, etc. the Acetone extract as well as the steam distillate is found larvicidal, growth regulator and adulticidal against *Culex quinquefasciatus, Anopheles Stephenson* and *Aedes aegyti* this plant is used as interrupt with *Abelmoschus esculentus* Moench (*Hibiscus esculentus* Linn.) for controlling root infesting nematodes.

Almost all species of *Tagetus* (Flowers, leaves, roots) are found insecticidal, repellant, fungicidal and nematicidal. Aqueous extract is used for ants, aphids and grasshopper whereas the fermented extract is found better for rice blast and tomato blight.

The crude extracts and its fractions of the flower of *Tagetes erecta* Linn. Was tested for insecticidal activity against a stored product insect pest, *Tribolium castaneum* (Herbst). The chloroform fraction showed highest toxicity against both the larvae and adults of *Tribolium castaneum* followed by 50 petroleum ether fraction and ethanol extract (Farjana Nikkon, *et al*., 2009).

Tagetes oil is a new biochemical pesticide active ingredient intended for use as an insecticide / acaricide for the control of mites, whiteflies, aphids, thrips, mealybugs, scales, and pyslla on a variety of food crops (Biopesticides registration action document, 2012).

Xanthium indicum Koen.

Habit: Herb.

Plant Distribution: Common throughout as a weed along roadsides and in waste places.

Herbs, annual; stem rough with short hirs. Leaves broadly ovate, triangular, appressed hairy. Heads 0.4-0.8 cm across, green (young), in terminal and axillary spikes. Fruits c 2 cm long, having 2 erect mucronate beaks, covered with hooked prickles. Achenes c 1*0.4 cm, oblong or ovoid, compressed, black.

Flowers and Fruits: **January-May**

Compounds and Biopesticide Properties

The aerial parts contain a volatile oil rich in sesquiterpene lactones, xanthinin and xanthatin and alkaloids. The seeds contain a fixed oil (35%). The leaves the exhibit nematicidal activity against various *Meloidogyne* species.

Tridax procumbens L.

Habit: Herb.

Plant Distribution: Common throughout as a weed in waste places.

Annuals or perennials, erect or procumbent herbs, branched at the base. Leaves opposite, ovate or lanceolate, margins serrate to coarsely incised dentate or trilobed. Heads heterogeneous, produced on erect, retrorsely hirsute and sparsely glandular peduncles, 10-25 cm long; ray florets white, ligules mostly bilabiate, disc florets tubular-campanulate, yellow, 5-lobed. Pappus of many aristate bristles, unequal in length. Achenes c 0.3 cm long, narrowly obconical, blackish, terete or ribbed, sparsely scarious, truncate at apex.

Flowers and Fruits: throughout the Year

Compounds and Biopesticide Properties

Tridax procumbens contains alkaloids, carotenoids, flavonoids (catechins and flavones), fumaric acid, FL-sitosterol, saponins and tannins. It is richly endowed with carotenoids, saponins, oleanolic acid and ions like sodium, potassium and calcium. Luteolin, glucoluteolin, quercetin and isoquercetin have been reported from its flowers (Sneha mundada, 2010).

Tridax procumbens along with eighteen weeds were selected, and a pesticide was produced from them by extraction method. The produced biopesticide was tested in 5 agricultural fields against tea, paddy, maize and cabbage plants. The pesticide was highly effective against aphids, leaf folder disease, thrips, Japanese beetle, army worm and the cutworm caterpillar. The effect of the pesticide derived from the agricultural weeds was around 50 to 75% more than the conventional chemical based pesticide (Manish Krishna, 2013).

CONCLUSIONS

Knowledge of the toxic plants, their toxic principles and their biological activity is of paramount importance not only to enable them to be utilized as natural pest control agents and replace the commercial synthetic pesticides, but also to enable us to understand the nature of their toxicity to non-targeted animals. Over 2,000 plant species have been reported to possess pesticidal activity (Crosby, 1971; Chakraboraty and Basu, 1997) out of about 2,500,000 angiosperms so far documented, only a fraction of which have been analyzed.

In Asteraceae, variations are enormous in which each subgroup specializes in one or more characteristics. Since evolution is never ending, this group represents different lines on which the evolution progressed and would progress.

This family is the most diverse family and its each and every part having noble biopesticidal activity. The work done till today on its biopesticide activities like insecticidal activity (toxicity), larvicidal activity, nematocidal activity, fungicidal activity, acaricide. Various species act against aphids, leaf folder disease, thrips, Japanese beetle, etc.

In future, there is huge room for research in the direction of more pesticide activities of the Asteraceae family and to elucidate the mechanism of action of the same.

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